WHAT IS CLAIMED IS:

1. A method comprising:

rolling a multilayer structure into a spiral structure; and

forming a fiber waveguide, wherein the forming comprises drawing a fiber preform derived from the spiral structure.

2. The method of claim 1, wherein the multilayer structure comprises at least two layers comprising materials with different refractive indices.

3. The method of claim 2, wherein the layers comprise a layer of a first material and a pair of layers of a second material sandwiching the first material layer.

4. The method of claim 2, wherein the layers are substantially planar.

5. The method of claim 2, wherein the different materials comprise a first material comprising a glass and a second material comprising a polymer.

6. The method of claim 2, wherein the different materials comprise a high-index material and a low-index material, and wherein a ratio of the refractive index of the high-index material to that of the low-index material is greater than 1.5.

7. The method of claim 6, wherein the ratio is greater than 1.8.

8. The method of claim 1, further comprising:

disposing at least a first layer of a first material on a second layer of a second material different from the first material to form the multilayer structure.

9. The method of claim 8, wherein the first material is disposed on both sides of the second layer.

10. The method of claim 8, wherein the second material is a polymer.

11. The method of claim 8, wherein the disposing comprises sputtering.

12. The method of claim 8, wherein the disposing comprises evaporating.

13. The method of claim 8, wherein additional layers are disposed on the first and second layers to form the multilayer article.

14. The method of claim 10, wherein the polymer comprises PES or PEI.

15. The method of claim 8, wherein the first material is a glass.

16. The method of claim 15, wherein the glass is a chalcogenide glass.

17. The method of claim 1, wherein the multilayer structure is rolled around a rod to form the spiral structure.

18. The method of claim 17, wherein the rod is hollow.

19. The method of claim 17, further comprising consolidating the spiral structure to form the preform.

20. The method of claim 19, wherein the consolidating comprises heating the spiral structure.

21. The method of claim 20, wherein the consolidating comprises heating the spiral structure under vacuum.

22. The method of claim 17, further comprising removing the rod from the preform prior to the drawing.

23. The method of claim 22, wherein the rod is removed by chemically etching.

24. The method of claim 1, wherein the spiral structure comprises a core surrounded by alternating layers of the multilayer structure.

25. The method of claim 1, where the fiber waveguide comprises a hollow core surrounded by multiple layers corresponding to the multilayer structure.

26. An article comprising:

a fiber waveguide comprising alternating layers of different materials surrounding a core extending along a waveguide axis, wherein the alternating layers define a spiral structure.

27. The article of claim 28, wherein the spiral structure comprises a multilayer structure comprising at least two layers of the different materials encircling the core multiple times.

28. The article of claim 26, wherein the different materials comprise a high-index dielectric material and a low-index dielectric material, and wherein a ratio of the refractive index of the high-index material to that of the low-index material is greater than 1.5.

29. The article of claim 28, wherein the ratio is greater than 1.8.

30. The article of claim 26, wherein the different materials comprise a polymer and a chalcogenide glass.

31. The article of claim 30, wherein the polymer comprises PES and the chalcogenide glass comprises As_2Se_3.

32. The article of claim 26, wherein the inner most layer of the alternating layers has a thickness smaller than that of subsequent layers of the same material.

33. The article of claim 26, wherein thicknesses of the alternating layers are selected to guide EM radiation along the waveguide axis at a wavelength of about 10.6 microns.

34. The article of claim 26, wherein thicknesses of the alternating layers are selected to guide EM radiation along the waveguide axis at a wavelength in the range of about 8-12 microns.

35. The article of claim 26, wherein thicknesses of the alternating layers are selected to guide EM radiation along the waveguide axis at a wavelength in the range of about 2-5 microns.

36. The article of claim 26, wherein the core is hollow.

37. The article of claim 26, wherein the fiber waveguide exhibits transmission losses smaller than about 1 dB/m at a selected wavelength for a straight length of the fiber.

38. The article of claim 37, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

39. The article of claim 38, wherein the selected wavelength is about 10.6 microns.

40. The article of claim 26, wherein the fiber waveguide exhibits transmission losses smaller than about 1.5 dB at a selected wavelength when bent around a 90 degree turn with any bending radius within a range of about 4-10 cm.

41. The article of claim 40, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

42. The article of claim 26, wherein the fiber waveguide is capable of guiding EM radiation along the waveguide axis at power densities greater than or equal to about 300 W/cm^2 for a selected wavelength.

43. The article of claim 42, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

44. The article of claim 43, wherein the selected wavelength is about 10.6 microns.

45. The article of claim 42, wherein the fiber waveguide is capable of guiding the EM radiation along the waveguide axis at power densities greater than or equal to about 300 W/cm^2 for the selected wavelength even when the fiber waveguide is smoothly bent around a 90 degree turn with a bent length of at least 0.3 m.

46. The article of claim 26, wherein the fiber waveguide is capable of guiding the EM radiation along the waveguide axis at powers greater than or equal to about 25 W for a selected wavelength.

47. The article of claim 46, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

48. The article of claim 47, wherein the selected wavelength is about 10.6 microns.

49. An article comprising a high-power, low-loss fiber waveguide comprising alternating layers of different dielectric materials surrounding a core extending along a waveguide axis, the different dielectric materials comprising a polymer and a glass.

50. The article of claim 49, wherein the alternating layers define a spiral structure.

51. The article of claim 50, wherein the spiral structure comprises a multilayer structure comprising at least two layers of the different materials encircling the core multiple times.

52. The article of claim 49, wherein the different materials comprise a high-index dielectric material and a low-index dielectric material, and wherein a ratio of the refractive index of the high-index material to that of the low-index material is greater than 1.5.

53. The article of claim 49, wherein the different materials comprise a high-index dielectric material and a low-index dielectric material, and wherein a ratio of the refractive index of the high-index material to that of the low-index material is greater than 1.8.

54. The article of claim 49, wherein the glass comprises a chalcogenide glass.

55. The article of claim 54, wherein the chalcogenide glass comprises As_2Se_3.

56. The article of claim 54, wherein the polymer comprises PES or PEI.

57. The article of claim 49, wherein the inner most layer of the alternating layers has a thickness smaller than that of subsequent layers of the same material.

58. The article of claim 49, wherein thicknesses of the alternating layers are selected to guide EM radiation along the waveguide axis at a wavelength of about 10.6 microns.

59. The article of claim 49, wherein thicknesses of the alternating layers are selected to guide EM radiation along the waveguide axis at a wavelength in the range of about 8-12 microns.

60. The article of claim 49, wherein thicknesses of the alternating layers are selected to guide EM radiation along the waveguide axis at a wavelength in the range of about 2-5 microns.

61. The article of claim 49, wherein the core is hollow.

62. The article of claim 49, wherein the fiber waveguide exhibits transmission losses smaller than about 1 dB/m at a selected wavelength for a straight length of the fiber waveguide.

63. The article of claim 62, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

64. The article of claim 63, wherein the selected wavelength is about 10.6 microns.

65. The article of claim 49, wherein the fiber waveguide exhibits transmission losses smaller than about 1.5 dB at a selected wavelength when bent around a 90 degree turn with any bending radius within a range of about 4-10 cm.

66. The article of claim 65, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

67. The article of claim 49, wherein the fiber waveguide is capable of guiding EM radiation along the waveguide axis at power densities greater than or equal to about 300 W/cm^2 for a selected wavelength.

68. The article of claim 67, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

69. The article of claim 68, wherein the selected wavelength is about 10.6 microns.

70. The article of claim 67, wherein the fiber waveguide is capable of guiding the EM radiation along the waveguide axis at power densities greater than or equal to about 300 W/cm^2 for the selected wavelength even when the fiber waveguide is smoothly bent around a 90 degree turn with a bent length of at least 0.3 m.

71. The article of claim 49, wherein the fiber waveguide is capable of guiding the EM radiation along the waveguide axis at powers greater than or equal to about 25 W for a selected wavelength.

72. The article of claim 71, wherein the selected wavelength is in a range of about 0.75 to about 10.6 microns.

73. The article of claim 71, wherein the selected wavelength is about 10.6 microns.